

CHAPTER 41

STREET LIGHTING

41.1 Street and Alley Lighting

This section of the manual is intended for use as a guide in the planning and design of a highway/street lighting system that conforms to Department policy. It will provide a means of developing uniformity in the design and plan preparation of highway lighting systems. Complying with all of the design criteria is sometimes difficult. It will require some judgment on the part of the designer to draw the necessary balance. However, it is necessary that the criteria be followed as closely as possible in order to achieve uniformity of design in highway/street lighting systems.

In March 2004, DDOT undertook a comprehensive study to develop a uniform streetlight policy throughout the city. This study was developed with the assistance of an advisory committee that included representatives from various agencies, citizens, community and historic preservation groups.

The study examined pole placement and color, light distribution and color, along with options for different poles based on street function, among other things. These standards are incorporated in this chapter of the Design and Engineering Manual.

It is recognized that situations will occur where good engineering judgment dictates deviation from this Department policy. Any such deviation shall be detailed in writing and submitted for approval from the Department. It is not the intent of this section to reproduce all the information that is adequately covered by textbooks and other publications that are readily available to the designer. This section, when used in conjunction with engineering knowledge of highway lighting design and good judgment, should enable the designer to perform their job more efficiently.

The terminology used in this manual, unless stated otherwise, is as defined in the current **AASHTO, An Informational Guide for Roadway Lighting**.

41.1.1 Guidelines

Uniform lighting will be used on new roadway projects. The guidelines shall be the **District of Columbia Streetlight Grand Plan Standards and Guidelines**, the current **AASHTO** and the **IES Lighting Handbook**, and the most recent supplemental revisions or guidelines approved by the District. All fixtures, poles, and designs will be reviewed and approved by the Electrical Engineer. Refer to the District's **Downtown Streetscape Regulations** for the streetlight design within the downtown streetscape boundary.

The purpose of streetlight installations is to illuminate the public traveled ways to a level that provides for the safe passage of public traffic, both vehicle and pedestrian. Street lighting of public streets and alleys in the District will be designed and installed in accordance with these Standards and the Department's standard specifications for street lighting. All street lighting designs shall be coordinated with the affected community. The designer shall choose from the current streetlight standards and lighting fixtures used in the District unless unique lighting system is required due to special situation or requirements. The streetlight design must be coordinated with the traffic signal design and utility company work by the designer.

In the historic districts designated by the State Historic Preservation Office (SHPO), the designer shall conform to the requirement of the SHPO and ensure to obtain necessary information prior to beginning the design. Lighting poles, arms and luminaires mounted on top of bridge parapets may be special types. The designer shall coordinate work performed in the vicinity of National Park Service (NPS) and Architect of the Capital (AOC).

41.1.2 Residential Areas

All lighting in residential areas shall be installed to minimize light shining on or negatively affecting the neighboring residents. Fixtures shall be located in such a manner that dark voids and excessive glare in windows are eliminated. The pole spacing shall be as required to obtain the necessary illumination levels and shall not exceed 150 feet and the streetlight mounting height for Acorn (Washington globe) fixtures should not exceed 15'-1" in residential areas. Minimum spacing should be 60'.

The use of luminaire shields may be used to minimize the glare of a conventional lighting system. Exceptions to reduce lighting requirements may be considered by the Department on a case-by-case basis. Street Lighting should be installed as listed in the DC Streetlight Grand Plan. Additionally, the use of prismatic globes in the Washington Globe fixture should be used as a general rule in order to reduce light pollution in night skies and to better focus the light.

41.1.3 Underground Service

Street lighting shall be installed with underground electric service on all new subdivision developments and reconstruction public streets in the District.

41.1.4 Streetlight Standard Color

Refer to the District's downtown streetscape regulation and the Memorandum of Understanding (MOU) between the District and the Business Improvement

Districts (BID) for the streetlights in the downtown and BID areas. The District's streetlight standard color shall be D.C Gray, Federal Chip No. 16099 unless directed otherwise. When a black pole is approved the color shall be Federal Chip No. 27038. The poles and arms shall be painted with either a two-part epoxy paint system or powder coated a color with the area design scheme. Add Green Chip and Red Chip for the Chinese Lantern Streetlights.

41.2 Layout Criteria

Lighting standard spacing and offsets shall be as uniform as possible. If it is necessary to vary the spacing or offset, it shall be done gradually keeping in mind that the minimum spacing shall be 60 feet and the maximum shall be 150 feet. In general, the lighting standards shall be located as follows:

41.2.1 Streets

41.2.1.1 Signalized Intersections

Signalized intersections will be lighted using pendant arm and combined streetlights and signal poles. Mounting of signals will be perpendicular to the flow line.

41.2.1.2 Railroad Crossing Lighting

Railroad crossing lighting will conform to the **Railroad-Highway Grade Crossing Handbook** (FHWA).

41.2.1.3 Sidewalks without Continuous Tree Space

Install streetlighting with a minimum of 3 ft clearance from the face of the curb to the centerline of the support pole and provide at least 3 ft. clear space for pedestrian walkway. In no case shall a streetlight be installed in front of a building door or sidewalk lead.

41.2.1.4 Sidewalks with Continuous Tree Space

Install streetlighting with a minimum of 3 ft. clearance from the face of the curb to the centerline of the support pole and provide at least 3 ft. clear space for pedestrian walkway. In no case shall a streetlight be installed in front of a building door or sidewalk lead.

41.2.1.5 Fire Hydrant Conflicts

When locating proposed lighting, avoid possible conflicts with fire hydrants. Install at least 6 ft. from fire hydrant.

41.2.1.6 Lighting in Under-crossings

All bridge underpasses, where vehicles, pedestrians, bicyclists, or equestrians may be present, shall require lighting. Lighting shall be provided from adjacent pole mounted luminaires for short underpasses or luminaires mounted to the underpass walls.

41.2.2 Main line Highways

Along outside lanes spaced opposite or staggered to suit the geometry and to provide the best lighting uniformity.

41.2.3 Ramps

In order to facilitate maintenance and relamping, it is desirable to locate the lighting standard along the inside radius; a setback of 5 ft.- 6 in. minimum is recommended.

41.2.4 Gore Area

It is desirable for a lighting standard to be located within the vicinity of an exit gore area. In no instance shall a lighting standard be located in a roadside recovery area.

41.2.5 Adjacent to Overpass

Care must be taken to avoid glare from mainline lighting affecting traffic on overpasses. Luminaire shields may be used to minimize the glare, if necessary. For typical (normal vertical clearance) overpass structures, luminaires shall not be located closer than 35 ft. from the face of parapets.

41.3 Lighting Systems

The designer shall request a list of approved luminaires and photometric requirements. Lighting poles mounted at grade shall be the Department's standard poles. The Department's standard poles shall conform to the **District of Columbia Commissions order 60-1090** for mounting approved arms and fixtures. The arm may be a special type, but must be capable of mounting on a standard pole. The support arms shall be reinforced with a bracket for streetlights on bridges and freeways. Care must be taken to avoid having a lighting bracket arm and luminaire mounted obstruct the driver's view of the signs.

41.3.1 Refractor Style Cobra (Pendant Arm)

- The refractor style cobra with a Type-3 cutoff distribution pattern mounted on poles shall be the standard construction for freeway installations in historic and non-historic areas. Poles located on Special Streets, as defined in the Grand Plan shall be outfitted in a decorate teardrop-style. See the Streetlight Grand Plan for pole-type placements in historic, non-historic with above ground wiring, non-historic with below ground wiring and special street areas.

Lighting shall be provided from adjacent pole mounted luminaries for short underpasses or luminaries mounted to the underpass walls.

41.3.2 Historic Streets

See Chart #1 found on Page #

41.3.3 Non-Historic Streets with Underground Power Lines

See Chart #2 found on Page #

Non-Historic Streets with Overhead Power Lines

See Chart #3 found on Page #

41.3.4 Standards for Special Streets

See Chart #4 found on Page #

In-kind Ornamental Streetlights of unique style of fixtures and light poles shall be installed on the district's historic bridges, including the special bridges as directed by the Department. Streetlights on these bridges shall be replaced in-kind when upgrading the bridges or streetlights.

Table 1. Standards for Non-Historic Streets with Underground Power Lines

Item	Roadway/Area Type			Bridges	Alley	Freeway	Tunnels/ Underpasses	Comments
	Commercial	Intermediate (Mixed Use)	Residential					
Pole Type	Decorative Teardrop (Alt. Cobra head^a), #14, #16, #18	Decorative Teardrop (Alt. Cobra head^a), #14, #16, #18	Decorative Teardrop (Alt. Cobra head), #14, #16, #18 ^b	Decorative Teardrop, #14, #16, #18 ^c	Cobra head (5A)	Cobra head	1.) all packs for vehicular Tunnels 2.) 14, #16, #18 for pedestrian tunnels	Citizens are to choose from available choices (text in bold is preferred choices)
Cutoff Criteria	Full Cutoff, Cutoff	Full Cutoff, Cutoff	Full Cutoff, Cutoff	Full Cutoff, Cutoff	Full Cutoff, Cutoff	Full Cutoff, Cutoff	N/A	
Color of Pole	Gray	Gray	Gray	To be selected based on Bridge Design	Gray	Gray	N/A	
Preferred Orientation	Staggered	Staggered	Staggered	Opposite	Staggered	Staggered	N/A	3.) d chosen for uniformity 4.) Opposite for bridge for aesthetics and symmetry
Min Spacing between poles^a	60 ft min (on one side) – all orientations							N/A
Height of pole	Depends on Pole Type							
Base of pole	Depends on Pole Type							N/A
Material of pole	Depends on the prevailing technology							N/A

^a Although Teardrop is preferred, Cobrahead is an alternative in cost-prohibitive situation.

^b Replace Upright in kind and Cobrahead changes to Teardrop or Upright.

^c Replace Upright in kind and Cobrahead changes to Teardrop. The pole can be any special decorative pole designed particularly for a bridge, but it cannot be Cobra head.

d For Special Case, the spacing can be less than recommended, but it must be justified. Minimum spacing between poles (60 ft) is not a recommendation, but an absolute minimum.

Table 2. Standards for Non-Historic Streets with Overhead Power Lines

Item	Roadway/Area Type			Bridges	Alley	Freeway	Tunnels/ Underpasses	Comments
	Commercial	Intermediate (Mixed Use)	Residential					
Pole Type^b	Decorative Teardrop (Alt. Cobra head ^a)	Decorative Teardrop (Alt. Cobra head ^a)	Decorative Teardrop (Alt. Cobra head ^a)	N/A	Cobra head (5A)	Cobra head	N/A	5.) Only lighting arm is to be used
Cutoff Criteria	Full Cutoff or Cutoff	Full Cutoff or Cutoff	Full Cutoff or Cutoff	N/A	Full Cutoff or Cutoff	Full Cutoff, Cutoff	N/A	
Color of pole	Gray	Gray	Gray	N/A	Gray	Gray	N/A	6.) Currently used
Preferred Orientation	Staggered	Staggered	Staggered	N/A	Staggered	Staggered	N/A	7.) Staggered chosen for uniformity
Min Spacing between poles^c	60 ft min (on one side) - all orientations			N/A	60 ft min (on one side) - all orientations	60 ft min (on one side) - all orientations	N/A	
Height of pole	Depends on Pole Type			N/A	Depends on Pole Type	Depends on Pole Type	N/A	
Base of pole	Depends on Pole Type			N/A	Depends on Pole Type	Depends on Pole Type	N/A	
Material of pole	Depends on the prevailing technology			N/A	Depends on the prevailing technology	Depends on the prevailing technology	N/A	

a Although Teardrop is preferred, Cobrahead is an alternative in cost-prohibitive situation.

b Existing Upright poles in overhead area will be phased out for consistency.

c For Special Case, the spacing can be less than recommended, but it must be justified. Minimum spacing between poles (60 ft) is not a recommendation but an absolute minimum.

Table 3. Standards for Special Streets

Criteria	Roadway/Area Type			Bridges	Alley	Freeway	Tunnels/ Underpasses	Comments
	Commercial	Intermediate (Mixed Use)	Residential					
Pole Type^a	Twin 20, Decorative Teardrop	Twin 20, Decorative Teardrop	Twin 20, Decorative Teardrop ^b	Twin 20, Decorative Teardrop ^b	N/A	Decorative Teardrop	N/A	8.) Twin 20s are DC signature poles 9.) Aesthetically more pleasing
Cutoff Criteria	Full Cutoff or Cutoff	Full Cutoff or Cutoff	Full Cutoff or Cutoff	Full Cutoff or Cutoff	N/A	Full Cutoff, Cutoff	N/A	
Color of pole^d	Dark Green/Black	Dark Green/Black	Dark Green/Black	Depends on Bridge Design	N/A	Dark Green/Black	N/A	10.) Existing color
Preferred Orientation	Opposite	Opposite	Opposite	Opposite	N/A	Staggered	N/A	11.) Opposite may be aesthetically more pleasing
Min Spacing between poles^c	60 ft, min (on one side) - all orientations				N/A	60 ft, min (on one side) - all orientations	N/A	
Height of pole	Depends on Pole Type				N/A	Depends on Pole Type	N/A	
Base of pole	Depends on Pole Type				N/A	Depends on Pole Type	N/A	
Material of pole	Depends on the prevailing technology				N/A	Depends on the prevailing technology	N/A	

Note:

- a For Special Streets with Overhead Power lines, Decorative Teardrop is recommended.
- b Replace Upright in kind and Cobra head changes to Teardrop. The pole can be any special decorative pole designed particularly for a bridge, but it cannot be Cobra head.
- c For Special Case, the spacing can be less than recommended, but it must be justified. Minimum spacing between the poles (60 ft) is not a recommendation but only an absolute minimum.
- d The Federal Chip # for Dark Green color is 24052.

41.3.5 Fixtures Attachment to PEPCO Poles

The designer may choose appropriate luminaries and design them based on the spacing of PEPCO poles and pole attachment befitting the existing situation.

41.3.6 Tunnel and Miscellaneous Fixtures

Special type of fixtures will be used in the tunnels, under-decks, sign structures, and in special situations. Wall mounted luminaries are preferred in tunnels and under-decks. The luminaires shall be located to facilitate maintenance and relamping.

41.4 Street Types and Light Level

41.4.1 Types of City Streets

Generally the existing streetlights will be replaced in-kind. In special situation, Pendant arm type standards may be replaced with Washington Globe or Teardrop Style fixture ~~when requested by the community.~~ Washington Globe (Acorn Fixture) will be used in the historic districts and designated historic streets. Street lighting will conform to requirements of streets and districts as follows:

Deleted:

- Historic Streets and Historic Districts on the National Register of Historic Places: Washington Globes. Twin Twenty is included as an option.
- Streets of Local Historic Interest: Washington Globes. Has to be designated as Historical. Cannot be historical based solely on community interest.
- Architect of the Capitol Area of Capitol Hill: Washington Globe-The Architect of Capitol (AOC) responsibility
- District Streets on Federal Lands (Streets Bounded by Federal Lands): National Park Service, Pennsylvania Development Authority etc. responsibility
- Downtown: Downtown Streetscape Regulations
- City Business Districts: MOU between DDOT and the subject BID
- Special Streets: Twin Twenty
- Arterial Streets:
- Collector Streets: for collector Streets except in the Historic Districts.
- Local Streets: Washington Globe on new subdivision streets
- Special Situations: There will be special situations when special unique style fixtures and standard will be required.

NOTE: The above streets/roadways can be residential or commercial/Business or intermediate type.

41.4.2. Level of Luminance

High-pressure sodium (HPS) luminaires will be used except at the DC mall where Metal Halide luminaires is in use or directed otherwise by the District or requirement of the community. The designer shall ensure that the proposed streetlight design meets the District's requirements and will work with the District and the affected community to deliver an approved design. Poles or luminaires that are equivalent to those described below may be approved by the District's Chief Transportation Engineer. City Street and highway Lighting shall conform to the requirements of **AASHTO. Guidelines** for luminance on the street/highway system are tabulated in Table 41-A.

Table 41-A:
Street Lighting Requirements

ROADWAY CLASSIFICATION	WATTAGE (HPS)	CONCRETE SURFACE FOOT CANDLES	REGULAR ASPHALT SURFACE FOOT-CANDLES	SMOOTH ASPHALT SURFACE FOOT CANDLES	UNIFORMITY RATIO
Pedestrian/Bike Walkways	W-150 or W-250	1.4	2.0	1.8	3:1
Residential					
Local	W-100 or W-150	0.3	0.4	0.4	6:1
Collector	W-150	0.4	0.6	0.5	4:1
Arterial	W-150	0.6	0.8	0.7	3:1
Intermediate					
Local	W-100 or W-150	0.5	0.7	0.6	6:1
Collector	W-150	0.6	0.8	0.7	4:1
Arterial	W-250	0.8	1.2	1.0	3:1
Commercial					
Local	W-150	0.6	0.8	0.7	6:1
Collector	W-250	0.7	1.1	0.9	4:1
Arterial	W-250 or W-400	1.1	1.6	1.4	3:1

41.5 Lighting at Intersections

All signalized intersections are to be illuminated. At signalized intersections, lighting shall be installed on traffic signal standards wherever possible. In general, the nighttime visibility of a pedestrian or hazardous object within an intersection is enhanced by increased contrast between the object and the surrounding street area. The optimum contrast (and hence safety) is achieved when the streetlights are situated to silhouette (or backlight) objects in the intersection. Therefore, streetlights at intersections are required to be placed on the downstream side of the intersecting

street, as viewed by a motorist approaching the intersection in the lane directly beneath the luminaire. Refer to Table 41-B. The positioning of light standards at intersecting streets shall be as follows

Table 41-B:
Intersection Light Locations

MAJOR COLLECTORS/ARTERIALS	4 LIGHTS, ONE ON EACH CORNER
Arterials/Arterials	4 lights, one on each corner
Arterials/Collector	2 lights, one on opposite corners
Collector/Collector	2 lights, one on opposite corners
Local/Collector	2 lights, one on opposite corners
Local/Local	1 light on one corner

41.6 Warrants for Highway Lighting

Refer to current **AASHTO, An Informational Guide for Roadway Lighting**.

41.6.1 Step 1

All highways within the District of Columbia warrant the installation of streetlighting, however, the designer shall check the AASHTO warrants prior to starting the design for any special conditions. To demonstrate this need, a system of warrants has been developed. **AASHTO** warrants shall be investigated before a final determination is reached. If highway lighting is warranted based on the following (except for under-deck/ tunnel lighting), then the designer shall proceed to Step 2.

41.6.1.1 Continuous Lighting (Freeway)

One of the following **AASHTO** warrants must be met to consider continuous lighting:

- CFL-3
- CFL-4
- Special considerations

41.6.1.2 Complete Interchange Lighting

One of the following **AASHTO** warrants must be met to consider complete interchange lighting:

- CIL-1 plus CIL-2
- CIL-3

- CIL-4
- Special considerations

41.6.1.3 Partial Interchange Lighting

One of the following **AASHTO** warrants must be met to consider partial interchange lighting:

- PIL-1 plus PIL-2
- PIL-3
- Special Considerations

41.6.1.4 Underdeck Lighting or Tunnel Lighting

AASHTO warrants must be met to consider under-deck and/or tunnel lighting. If lighting is warranted, the designer shall prepare the design and skip Step 2.

41.6.1.5 Additional Design Considerations

Additional lighting shall be considered warranted for ramps, mainline or acceleration lanes for any of the following reasons:

41.6.1.6 Ramps

- Inside radius of entrance or exit ramp is less than 150 ft.
- Accident data in the ramp area indicates a problem exists.

41.6.1.7 Acceleration Lanes

- Stop before acceleration lane.
- Grade and/or curvature present a visibility problem, which cannot be corrected through other means.
- Sidewalks exist to permit pedestrians to cross at the entrance or terminal of a ramp.

41.6.1.8 Main Line

The designer shall obtain the accident data of the location in order to determine the night-to-day accident ratio. The ratio could dominate the determination if highway lighting is required.

- Grade and/or curvature present a visibility problem, which cannot be corrected through other means.
- Bridges without shoulders.

41.6.2 Step 2

If lighting is warranted based on the **AASHTO** warrants, then the need for lighting on a particular highway or interchange must be considered utilizing the appropriate evaluation.

41.7 Street Lighting Design

The Department's approved luminaire and supporting poles and arms shall be used for all streetlight designs in the District. The environmental impact, especially on residences, of each system shall be investigated. The use of luminaire shields may be used to minimize the glare of a conventional lighting system. Upon approval, the designer shall then address, analyze and compare such determining factors as initial installation cost, maintenance costs, and energy consumption costs of the remaining system(s). All illumination and electrical design shall meet criteria as specified hereinafter. Before work commences on the lighting design, the designer must request approval of all design parameters by the Electrical Engineer.

- The designer shall be prepared to present, explain and defend his lighting system choice and design at any public or other meetings, as required.
- The designer shall prepare 20 ft. scale drawings of all systems to be included with the report, and based upon their investigations and analyses, shall make a recommendation to the Department of the system best suited to the project.
- The designer shall not intermix a Department lighting system within a utility company wood pole transmission system.
- The designer is responsible for locating and identifying the horizontal and vertical clearances of the utility company's primary (750 volts or more) and secondary power lines.
- The designer shall coordinate the electrical design work with the present and future plans of the utility companies. All overhead and underground utilities must be shown on the plans. There shall be no conflicts with the lighting installation
- When utility poles are required to be relocated and wood poles lighting shall be the sole source of illumination for a section of highway, the designer shall work with the affected utility to space and position utility poles, through the utility agreement in conformance with utility standards, to produce a suitable illuminance. However, if needed to affect a quality design the designer shall call for the installation of additional District owned wood poles, outside of the utility companies pole transmission system.

41.7.1 Reference Publications

- **AASHTO An Informational Guide for Roadway Lighting**
- **FHWA Roadway Lighting Handbook**
- **FHWA Manual on Uniform Traffic Control Devices (MUTCD)**
- **Illuminating Engineering Society (IES) Lighting Handbook**

NOTE: All publications shall be the latest edition.

41.7.2 Basis for Lighting Calculation

41.7.2.1 Common Criteria

The following are common for all types of highway lighting systems:

41.7.2.1.1 Photometric Data

The Photometric data utilized in all calculations shall be the latest data available.

41.7.2.1.2 High Pressure Sodium Lamps

Table 41-D shows the high-pressure sodium lamps with the following initial lumens that shall be used:

Table 41-D:

ANSI		RATED AVG.	INITIAL
Wattage	Designation	Life Hours	Lumens
70	S62-MF-70	24,000	6,400
100	S54-SB-100	24,000	9,500
150	S55-SC-150	24,000	16,000
250	S50-VA-250	24,000	27,500
400	S51-WA-400	24,000	61,000

41.7.2.1.3 Maintenance Factors

All lighting Systems depreciate with time. The design values shall consider appropriate reduction in initial illumination values. The maintenance factor to be utilized is 0.75; 0.68 for ambient areas considered dirty.

41.7.3 Other Considerations

The following considerations are to be incorporated in all lighting calculations (Actual width of highway pavement considered in calculations, including shoulders, excluding medians where they exist):

- Selection of proper size of luminaires to accommodate the level and uniformity of illumination.

- Selection of proper length of bracket arms to provide maximum efficiency and uniformity in lighting. It should be noted that in some areas the use of two different lengths of bracket arms may meet the above requirements, but may also produce an objectionable appearance with regard to the luminaire alignment.
- Where the geometry or the uniformity ratio requirements necessitate adjustments in the calculated lighting standard spacing, closer spacing shall be used.
- Contributions from all luminaires that have an effect on the area considered shall be taken into account to obtain the lux values.
- When adjacent to sign structures, it is desirable to locate lighting standards equidistant from sign structures. The lighting standards shall not be located within 50 ft. of the structure. Care must be taken to avoid having a lighting bracket arm and luminaire mounted at 26 ft. obstruct the driver's view of the sign legend.
- When locating lighting poles near overhead sign structures, the pole shall be located so as not to affect the driver's view of the sign message. Any adverse glare will be handled by the use of luminaire shields.

41.7.4 Lighting Calculations

41.7.4.1 Methods of Calculation

For the preliminary design, the average point method shall be used. The lighting will be designed utilizing a District approved lighting design program. Special design software for tunnels must be used when designing tunnel lighting. However, other lighting design software may be approved, but the designer would be responsible for providing the Department a registered copy of the software and training at no cost to the Department. The current photometric data to be used in the calculations shall be provided by the District upon written request.

41.7.4.2 Calculation Guidelines

The following are to be followed when performing the calculations:

- When a portion or section of the highway is under analysis, it shall be analyzed as a self-contained area (main area). Sub-division (sub-area) within the main area is not permitted.
- The self-contained area (main area) of analysis shall correspond to the highway geometry under investigation.
- The point-to-point interval shall be 5 ft. longitudinally and transversely.
- The entire section of highway that is being illuminated shall be analyzed completely (It can be analyzed with many main areas).

The following information shall be included with each analysis:

- Project identification.
- Plan sheet number involved in calculations.
- A station-to-station identification of the area being analyzed.
- The identification of each contributing luminaire being analyzed.

The following guidelines must be adhered to when submitting the design data on diskettes for review:

- Prepare a formatted 3.5 in. diskette to accept project.
- When the analysis is completed, copy each project to the diskette in the format recommended by the software provider.

41.7.5 Power Source

41.7.5.1 Incoming Service

The secondary service obtainable from the local utility company's pole or manhole shall be used to service the complete installation in each area. The lighting will be designed utilizing a District approved lighting design program. Information on payee of the energy charge shall be provided in the letter. For all streetlight and alley light designs the designer shall supply the utility with a complete set of drawing for them to review and approve the location of all connections. Where an electrical service is required for a underpass or tunnel the designer shall request a class of service from the utility company. The form to make the request will be obtained from the utility company and completed in full. The designer shall supply a copy of the request to the District. Standard services available from the utility company are as follows:

- Single phase-3 wire: 120/240V and 240/480V, 120/240 volt service is preferred for all street and alley lighting. However, in areas where that class of service is not available that the use of 240 volt circuit is allowed.
- Phase - 3 Wire: 120/240V and 240/480V, the latter is preferred. The utility company provides this special secondary voltage to the Department exclusively. Utilized voltage shall be 240 volts.
- Three Phase - 4 Wire: 265/460V and 277/480V, dependent on the utility company. Utilized voltage shall be 265 or 277 volts.

When service is obtained from a manhole, the designer shall consult the utility company for the size, location, material and termination of the service conduit. The utility company usually furnishes the service wires, however this shall be verified.

41.7.5.2 Load Center Designations

Obtain the designation from the Electrical Engineer when a load center is added to the Street/highway lighting system.

41.7.5.3 Circuitry and Other Considerations

In most cases, where the wire fill will permit, all cables for two or more lighting circuits may be installed in the same conduit. Nominal size of cable used in highway lighting circuits shall be according to the NEC, however, in cable smaller than #10 AWG 60 Volt shall be used. Other sizes may be used and shall be approved by the Electrical Engineer. It is reminded that, unless necessitated otherwise, variations in cable sizes shall be avoided. All street and alley lights shall be controlled by a photocell mounted on each fixture or luminaire.

The designer shall utilize both phases of a circuit and connect the lighting so that no two consecutive lights are connected to the same phase in case of a lost of a single phase. The use of fused connector kits for each luminaire shall not be permitted.

Lighting circuits, including the future lighting extensions, where required, shall be designed generally for a maximum of 5 percent voltage drop at the terminal point of each circuit. It is calculated between the phase and neutral.

41.7.5.4 Balanced Lighting Circuits

All lighting Circuits Shall be Balanced. Lighting circuits shall be so arranged that in case of failure in one of the circuits, it shall be possible to reroute the failed circuit with minimum work. In order to accomplish this flexibility in the circuitry, an empty conduit shall be provided to connect the conduit systems of adjacent load centers where feasible.

All conduit duct banks shall be provided with spare ducts for future use. On all highways where imminent widening is contemplated, the locations of the lighting system shall be outside the limits of the future widening. The system shall be designed so that the permanent lighting installations shall be completed and in operation when a new highway is opened to traffic. If this cannot be accomplished, temporary lighting shall be provided.

41.7.6 Under-Deck Lighting

Under-deck lighting is not installed to accent the highways beneath structures, but rather to provide the required level of illuminance to accent continuity of uniform lighting. Therefore, under-deck lighting shall only be required where this level of illuminance, due to structural limitations such as the width,

skews, and minimum clearance cannot be accomplished by means of lighting standards.

Wall mounted under-deck luminaires shall be installed on pier faces and/or on abutments at a minimal mounting height of 15 ft. The pier faces or the abutment must be parallel to the highway and must be within 10 ft. from the curb or edge of the highway, otherwise the luminaires shall be fastened to adapter plates installed between the bridge girders. Wall mounted under-deck luminaires installed at a mounting height of more than 15 ft. shall yield better efficiency and uniformity.

Pendant type luminaires shall be mounted from the structural steel. The luminaires shall be located to facilitate maintenance and relamping. If the highway width permits, the luminaires shall be located over the shoulder. When a luminaire is suspended from a bridge structure over the traveling lane, the bottom of the luminaire shall not be lower than the bridge girder. A special detail may be necessary to detail the conduit layout under the structure. For calculation purposes, the following data shall be used:

- Mounting Height - As required (15 ft. nominal).
- Luminaires- 150-watt wall mounted type and pendant mounted type high-pressure sodium luminaires as per the current industry standard.
- Uniformity Ratio

On highways, which are not illuminated, under-deck lighting shall be provided for underpasses having pedestrian traffic. The average maintained illuminance shall be .8 ft. candle.

41.7.7 Sign Lighting

The following guidelines shall be used to determine if sign lighting is to be provided for Overhead Signs:

- The tangent sight distance is less than 1200 ft. due to horizontal or vertical curve or other sight obstruction.
- Geographic and/or geometric conditions may warrant sign lighting for the following situations and an evaluation shall be made:
 - Diagrammatic signs
 - “Exit Only” lane drops
 - High volume interchange (interstate to interstate)
 - Areas with high concentration of dew or frost
 - Sheeting material retroreflectivity characteristics

When it is determined that overhead sign lighting is to be provided, the lighting level shall conform to AASHTO recommendations. 100W high Pressure Sodium vapor luminaries shall be used for lighting of all overhead

signs. The designer shall coordinate the electrical details and the details of the sign structure. A minimum of two luminaires shall be provided for each sign panel. Where sign lighting is not required, walkways and luminaire supports are not to be provided, but the design of the sign structure shall allow for the future installation of walkways and luminaire supports.

41.7.8 High Mast Lighting Systems

The lighting calculations to determine the required illumination shall be based on the following definitions and criteria:

41.7.8.1 Area

Only the traveled highway and ramps, including shoulders, shall be considered in the calculations.

41.7.8.2 High Mast Lighting Standard Assembly Setback

Minimum 30 ft. measured from the face of curb or edge of pavement to centerline of high mast lighting standard. A lesser setback may be used. Should a lesser setback be approved, appropriate protection must be provided.

41.7.8.3 Luminaires

High mast type 250 or 400-W or 1000-W high-pressure luminaires - The luminaires shall produce a symmetric, long and narrow or asymmetric distribution. A maximum of eight luminaires of the same or different distribution shall be clustered to provide the required pattern of light distribution from the high mast lighting assembly.

41.7.8.4 Mounting Height

The tower shall not be more than 100 ft. The actual highway elevations shall be used in the calculations.

Deleted:

41.7.9 Existing Highway Lighting System

When an existing lighting system is being affected by construction and the light source is other than high-pressure sodium, it shall be converted to high-pressure sodium. The existing series circuits shall be converted into parallel circuits for all city street and highway lights.

41.7.10 Temporary Lighting

All roadway construction projects within the District where the existing lighting system cannot be maintained during construction shall use temporary lighting. This lighting can be a mixture of existing poles, temporary poles for construction or parts for the new system being installed. In no case will the illumination levels be less than the existing illumination levels entering and exiting the project limits.

41.7.10.1 Designing the Temporary Lighting

Temporary lighting design is concerned with the duration and location of the lighting units, to provide the proper illuminance and increase safety in the construction areas with minimum expenditure. The designer shall design a simple yet safe temporary lighting system that conforms to the NEC as a minimum. The designer shall consider the following options:

- Investigate the possibility of installing certain proposed lighting assemblies, including underground facilities in the early stage of construction and utilize them as the temporary lighting.
- The use of wood poles.
- Regardless of what type of temporary lighting facilities, the contractor shall maintain the installations, until they are no longer required and then remove the portions that are not part of the permanent lighting system.

41.7.11 Conduit

Conduit used for roadway and alley lighting projects shall be sized accordingly:

- 1-2 inch used between manhole/junction box and light pole.
- 1-2 and 1-4 used between manhole and all light pole installed at an intersection
- 2-4 inch used between PEPCO feed point and DC manhole/junction box
- 1-4, 2-4, 4-4 and 6-4 inch used between DC manholes for mainline runs

41.7.11.1 Rigid Non-Metallic Conduit (RNM)

All conduit install underground by trenching for street and alley lighting shall be gray PVC Schedule 40 and encased in concrete. Conduit installed by directional boring shall be PVC and manufactured to be installed by this method.

41.7.11.2 Fiberglass Or Metallic Conduit

Fiberglass or rigid metallic conduit shall be used for all conduit installed encased on structures. Proper expansion and deflection fittings shall be used to allow for movement. A five foot section of metallic conduit shall extend outside of each wing wall and be connected to a manhole or junction box as required. Fiberglass or rigid metallic conduit shall be install on exposed locations, such as hanging under bridge decks or mounted on the surface of walls.

NOTE: A ground wire shall be installed in all DDOT conduit where required by the NEC.

41.7.12 Cables and Wire

All cables and wire used in District roadway and alley lighting projects shall be in compliance with DDOT's standard specifications. All cable used will be color coded in compliance with the NEC. In areas where more than one lighting circuit is installed together the cables and wires shall be tagged and marked with the circuit information for easy identification and maintenance.

41.13 Junction Boxes and Foundations

Manholes/Junction Boxes shall be designed as part of a complete lighting system. All manholes shall be concrete and be constructed by pre-casting or cast-in- place, junction boxes shall be polymar concrete. Spacing shall be as required be not greater than 250 feet between manholes and/or junction boxes. Drainage will be provided in all manhole/junction boxes by the use of gravel. All manholes will have galvanized racks installed so that cables can be racked on the walls.

The District is as part of paving and reconstruction projects is installing conduit and manholes in order to construct a streetlight distribution system separate from PEPCO's. The only connection to PEPCO is through two-four inch conduits built from the District manhole to the distribution manhole identified by PEPCO as a feed point. The District's system is made up of six-four inch conduits and manholes on major streets. In neighborhoods and in all alleys the system consists of two-four inch conduits and manholes. In all cases one manhole will connect three to four streetlights, and be located no further than 250 feet apart.

41.14 Voltage Drop Calculation Method

Voltage drop will be calculated on all electrical and lighting circuits. The method used and all of the calculations will be furnished to the District by the Designer as

Deleted: ¶

part of the design documents. The voltage drop shall not exceed 5 percent on any circuit.